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CRITICALITY SAFETY SUPPORT TO A PROJECT ADDRESSING SNM LEGACY ITEMS AT LLNL

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ABSTRACT

The programmatic, facility and criticality safety support staffs at the LLNL Plutonium Facility worked together to successfully develop and implement a project to process legacy (DNFSB Recommendation 94-1 and non-Environmental, Safety, and Health (ES&H) labeled) materials in storage. Over many years, material had accumulated in storage that lacked information to adequately characterize the material for current criticality safety controls used in the facility. Generally, the fissionable material mass information was well known, but other information such as form, impurities, internal packaging, and presence of internal moderating or reflecting materials were not well documented. In many cases, the material was excess to programmatic need, but such a determination was difficult with the little information given on MC&A labels and in the MC&A database. The material was not packaged as efficiently as possible, so it also occupied much more valuable storage space than was necessary. Although safe as stored, the inadequately characterized material posed a risk for criticality safety non-compliances if moved within the facility under current criticality safety controls.

A Legacy Item Implementation Plan was developed and implemented to deal with this problem. Reasonable bounding conditions were determined for the material involved, and criticality safety evaluations were completed. Two appropriately designated glove boxes were identified and criticality safety controls were developed to safely inspect the material. Inspecting the material involved identifying containers of legacy material, followed by opening, evaluating, processing if necessary, characterizing and repackaging the material. Material from multiple containers was consolidated more efficiently thus decreasing the total number of stored items to about one half of the highest count. Current packaging requirements were implemented. Detailed characterization of the material was captured in databases and new ES&H container labels applied. In many cases, legacy material that was inspected was determined to be excess to programmatic needs and it was then either processed to meet the DOE-3013-STD or designated as TRU waste and disposed of accordingly. During FY2003 through FY2004 approximately 1600 items were opened and the items processed if necessary, repackaged and newly labeled with ES&H labels. As of April, 2005, there are only 32 non-ES&H labeled items in existence within the Plutonium Facility.

Due to a consolidated effort in dealing with the legacy items, the problems associated with storage of these items at LLNL has been substantially abated. The paper will discuss the background, implementation, and results of the SNM Legacy Items Implementation Project. Benefits and Lessons Learned will be identified.

Key Words: criticality, safety, legacy, material

1 INTRODUCTION

The Programmatic, Facility and Criticality Safety support staffs at the Lawrence Livermore National Laboratory (LLNL) Plutonium Facility worked together to successfully develop and implement a project to process legacy (DNFSB Recommendation 94-1 and non-Environmental, Safety, and Health (ES&H) labeled) materials in storage. Generally, the fissionable material mass information was well known, but other information such as form, impurities, internal packaging, and presence of internal moderating or reflecting materials were not well documented for the legacy items. Although safe as stored, the inadequately characterized material posed a risk for criticality safety non-compliances if moved within the facility under existing criticality safety controls.

A Legacy Item Implementation Plan was developed and implemented to deal with this problem. Bounding conditions were determined for the material involved, and criticality safety evaluations were completed. Two appropriately designated glove boxes were identified and criticality safety controls were developed to safely inspect the material. During FY2003 through FY2004 approximately 1600 items were opened and the items processed if necessary, repackaged and newly labeled with current ES&H labels. As of April, 2005, there are only 32 non-ES&H labeled items in existence within the Plutonium Facility.

Due to a consolidated effort in dealing with the legacy items, the problems associated with storage of these items at LLNL has been substantially abated. This paper will discuss the background, implementation, and results of the SNM Legacy Items Implementation Project. Benefits and Lessons Learned will be identified.

2 BACKGROUND

On May 26, 1994, the Defense Nuclear Facilities Safety Board (DNFSB) submitted recommendation 94-1 (Reference 1) that raised safety concerns about storage of various materials in the nuclear complex. On January 14, 2000, the DNFSB submitted recommendation 2000-1 (Reference 2) that reemphasized their concern about the materials. These two recommendations resulted in a number of additional reports, a 2000-1 Implementation Plan (Reference 3) and a packaging specification, DOE-STD-3013 (Reference 4). In the Implementation Plan, each DOE site made a set of commitments to address the concerns raised in the DNFSB recommendations 94-1 and 2000-1. LLNL is one of the sites included in the Implementation Plan.

3 IMPLEMENTATION AT LLNL

At LLNL a 94-1 Project was established. The legacy material items were inventoried, after which materials were grouped, handled, and processed accordingly. Oxide that was approximately 80 weight percent pure went straight to the Loss-on-Ignition (LOI) furnace to be calcined and then packaged to meet the DOE-STD-3013. If the material was between 20 and 80 weight percent pure, it was first processed through oxide washing that removed all water-soluble impurities, and then the clean material was processed to meet the DOE-STD-3013 for storage. All materials below 20 weight percent purity were dispositioned as TRU waste. During this

project, material identified by the program as programmatically necessary was removed from the 94-1 processing list and returned to the program. Criticality safety evaluations and the corresponding controls were implemented for each of these processes, consistent with the work control process for the Plutonium Facility.

A second set of items was designated as “legacy” material; material in storage that lacked a current Environmental, Safety, and Health (ES&H) label. Over many years, material had accumulated in storage that lacked information necessary to adequately characterize the material for the current criticality safety controls used in the facility. Generally, such material had been packaged and stored many years earlier when requirements for packaging and labeling the material were less robust than current requirements. Generally, the fissionable material mass information was well known, but other information such as form, impurities, internal packaging, and presence of internal moderating or reflecting materials were not well documented. In many cases, the material was excess to programmatic need, but such a determination was difficult to make with the limited information available on Material Control and Accountability (MC&A) labels and in the existing MC&A database. In addition, such material typically was not packaged efficiently, so it occupied much more valuable storage space than necessary. Although safe as stored, the inadequately characterized material posed a risk for criticality safety non-compliances if moved within the facility under current criticality safety controls.

The Environment, Safety and Health (ES&H) label was initiated as part of the Plutonium Facility resumption activities in 1998. It was determined at that time that a label with more detailed information on each package of special nuclear material (SNM) stored in the Plutonium Facility was needed on the outermost layer of packaging to verify that the item was meeting work station criticality controls. When this effort was initiated, there were approximately 1900 stored items lacking the newly established ES&H label. Completion of the label data fields required knowledge of the item and packaging. Therefore, a campaign was initiated to complete the labeling of those items for which Lawrence Livermore National Laboratory (LLNL) had current process knowledge. For those items where recent process knowledge was not available, a campaign was initiated to transfer each item from a vault storage location to a plutonium glove box, where it was opened, inspected, processed if necessary, and repackaged with the ES&H label attached to the outermost container.

To deal with the problems associated with inadequate information concerning legacy materials, a Legacy Item Implementation Plan (LIIP) was developed. The LIIP was submitted to the NNSA Livermore Site Office for review and approved. Key aspects of the LIIP, which proved important to the success of the plan, included:

1. The management and staff of the Plutonium Facility, Programs and Criticality Safety Section worked together closely to develop and implement the LIIP. All stakeholders were involved in the process, including regulatory approval of the plan.
2. Lists of potential legacy material items were developed. All available information concerning the legacy items was collected and reviewed (e.g. container size, form, net weight, gross weight, storage locations, packaging notes, etc.).

3. The Criticality Safety Section assessed the technical basis for the legacy items, assuming upper-bound conditions (normal and off-normal). The identified legacy items were determined to be safe as stored, presenting no immediate safety concern.
4. As a compensatory measure, rules were established limiting the storage and movement of legacy items until they could be safely opened, properly characterized and labeled with new ES&H labels.
5. Two appropriate workstations were identified which posed minimal off-normal hazards. For example, design features addressed the possibility of introducing water or other moderator or reflector materials.
6. Criticality safety controls were developed to safely inspect the material, and a criticality safety evaluation provided the technical basis. The controls and technical basis were developed specific to the facility and the identified legacy item information. One legacy item at a time was allowed, and limitations were placed on the allowed containers and contents. The fissile material mass and total net weight was limited. Further guidance from criticality safety professionals was required if unusual contents were discovered, such as liquids or superior moderator or reflector materials.
7. Inspecting the material involved identifying containers of legacy material, followed by opening, evaluating, processing if necessary, characterizing and repackaging the material.
8. Once inspected and characterized, material from multiple containers was consolidated more efficiently, thus decreasing the total number of stored items to about one half of the highest original count. Current packaging requirements were implemented.
9. Detailed characterization of the material was captured in databases, and new ES&H container labels were applied.
10. In many cases, legacy material that was inspected was determined to be excess to programmatic needs and it was then either processed to meet the DOE-STD-3013 or designated as TRU waste and dispositioned accordingly.

4 RESULTS

The 94-1 Project dealt with the first set of the legacy items discussed above. At completion, the program had processed 155.6 kg of plutonium plus uranium, returning 23 kg plutonium to the programs at LLNL for specific programmatic needs. Material determined to be excess to programmatic needs was then either processed to meet the DOE-STD-3013 or designated as TRU waste and dispositioned.

Processing the second set of legacy material items is nearly completed. The items were processed, if necessary, repackaged, and new ES&H labels with current information were affixed. As of April 2005, there are only 32 items without ES&H labels remaining within the Plutonium Facility. During this process, no significant problems were found with the integrity of the containers (e.g. no breached or paneled cans were found). A few of the actual can contents differed from expected, although none of these differences led to actual safety concerns. Such cases were dealt with using the protocol established by the LIIP.

During FY2003 through FY2004, approximately 1600 items were opened (which involves opening 3200 containers, primary and secondary).

5 BENEFITS

Several important benefits resulted from this effort:

1. By performing the stabilization processes on the materials bound for storage to meet the DOE-STD-3013, and by repackaging other materials for programmatic use, the inventory of legacy material has been significantly consolidated and the final packaging is now very well characterized.
2. Processing legacy material items through the LIIP greatly enhanced the understanding of the item contents for safety purposes and reduced the chance of future criticality safety non-compliances.
3. The repackaged items are now in currently accepted containers with well-characterized and documented contents.
4. The number of individual items was greatly reduced, requiring fewer storage locations.

6 LESSONS LEARNED

Several “lessons learned” were identified:

1. The presence of legacy items presents a potential for future safety concerns, or at least a potential for safety non-compliances.
2. The LIIP provided a systematic and safe approach for processing legacy material items. The LIIP was developed specifically to meet the situation and needs concerning legacy material items stored in the Plutonium Facility.
3. Developing a systematic approach to processing the legacy material items, and involving all stakeholders in the process, greatly facilitated the efficiency of the process and helped to avoid difficulties, which could have arisen from encountering unexpected problems.

7 CONCLUSIONS

The Programmatic, Facility and Criticality Safety support staffs at the LLNL Plutonium Facility worked together to successfully develop and implement a project to process legacy (DNFSB Recommendation 94-1 and non-Environmental, Safety, and Health (ES&H) labeled) materials in storage.

A Legacy Item Implementation Plan was developed and implemented to help deal with this problem. All stakeholders, including the regulator, were consulted in developing the plan. The Criticality Safety Section was closely involved with the process, and provided guidance, criticality safety controls, and an appropriate technical basis. The bounding conditions were determined for the material involved, and criticality safety evaluations were completed. Two appropriately designated glove boxes were identified and criticality safety controls were

developed to safely inspect the material. Inspecting the material involved identifying containers of legacy material, followed by opening, evaluating, processing if necessary, characterizing and repackaging the material. Material from multiple containers was later consolidated more efficiently thus decreasing the total number of stored items to about one half of the highest count. Current packaging requirements were implemented. Detailed characterization of the material was captured in databases and new ES&H labels were applied. In many cases, legacy material that was inspected was determined to be excess to programmatic needs and it was then either processed to meet the DOE-STD-3013 or designated as TRU waste and dispositioned. During FY2003 through FY2004, approximately 1600 items were opened and the items were processed if necessary, repackaged and labeled with current ES&H labels. As of April, 2005, there are only 32 non-ES&H labeled items in existence within the Plutonium Facility.

Due to this consolidated effort in dealing with the legacy items, the problems associated with storage of these items at LLNL has been substantially abated.

8 ACKNOWLEDGMENTS

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